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Draft Methodology principles for quantifying GHG emissions savings under the Innovation Fund

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The draft methodology

- Draws on existing methodologies and is aligned to the extent possible with existing legislation, such as RED2 and ETS, however:
- Innovation fund applies to **projects** to save emissions. There may be multiple *products.*
- The emissions may be saved in any sector.
- ETS benchmarks concern only direct emissions,from the factory, but IF concerns all lifecycle GHG emissions.
- IF is concerned with technologies, which will be commercialized in the future.
- IF also includes cost efficiency: main indicator is (scaled) CO2e saved per €
- IF includes CCS-based projects, electricity storage, GHG savings in use…

Why not just use existing LCA guidelines?

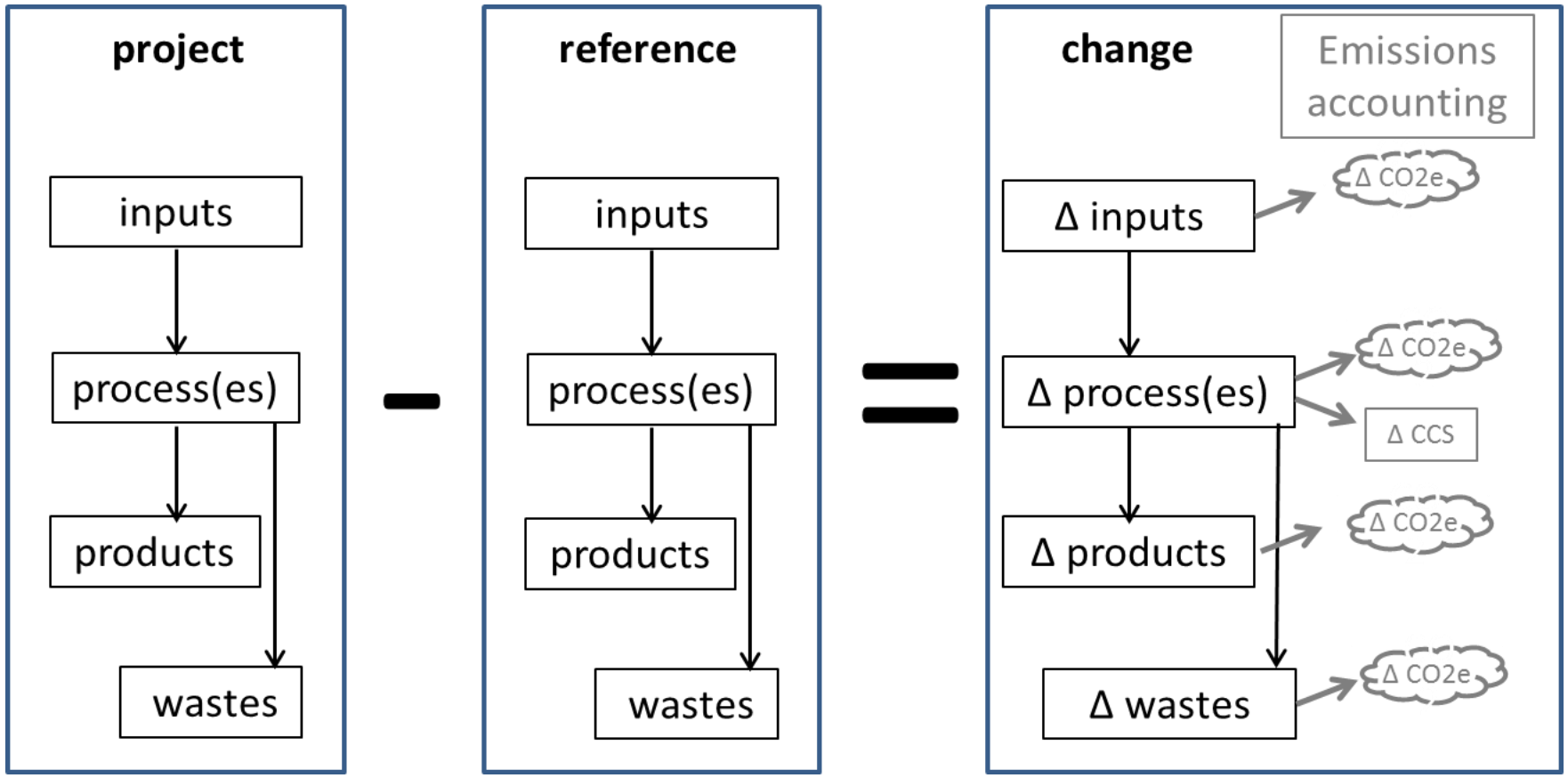
- e.g. ISO 14040/44, ILCD handbook*, PEF
- Some important methodological choices are left to the user
- Choice of literature data left to users
- Do not give unambiguous LCA results
- Studies often falsely claim to follow ISO
- (e.g. even PEF has a non-ISO hierarchy of allocation methods)
- They help guide disinterested scientists
- No good by themselves for legislation

*http://eplca.jrc.ec.europa.eu/?page_id=86#

THE METHOD

1. General Provisions/ basis of the method
2. GHG intensity of inputs
3. Accounting for CO_2 capture
4. Allocation to multiple products
5. Electricity as a input
6. GHG savings in the use phase

1.1 Basis of the method



ΔEmissions(project) = ΔE(inputs) + ΔE(processes) + ΔE(products)

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1.2 What is the reference scenario?

- FOR NEW PLANTS,
  - Emissions from an ETS benchmark installation for “process” box,

    + “inputs” + “products”
- FOR MODIFICATIONS OF EXISTING PLANTS
  - The unmodified plant (near-term savings)

    - PROVIDED that the overall emissions of the modified plant reach the emissions from an ETS benchmark installation.

The “overall emissions” would, for example, include a credit for a fuel by-product that replaces gasoline.

1.3 General provisions of the method

- For simplification, the emissions for construction are not usually counted*
- But we *do* consider CO_2, CH_4 and N_2O emissions arising from:
  - supplying and processing the inputs
  - process emissions
  - transport and distribution
- Miscellaneous input chemicals responsible for less than 5% of emissions: GHGi from the published input data for RED2 default calculations for biofuels etc.
  - The hierarchy of sources is listed in annex 2, to prevent cherry-picking

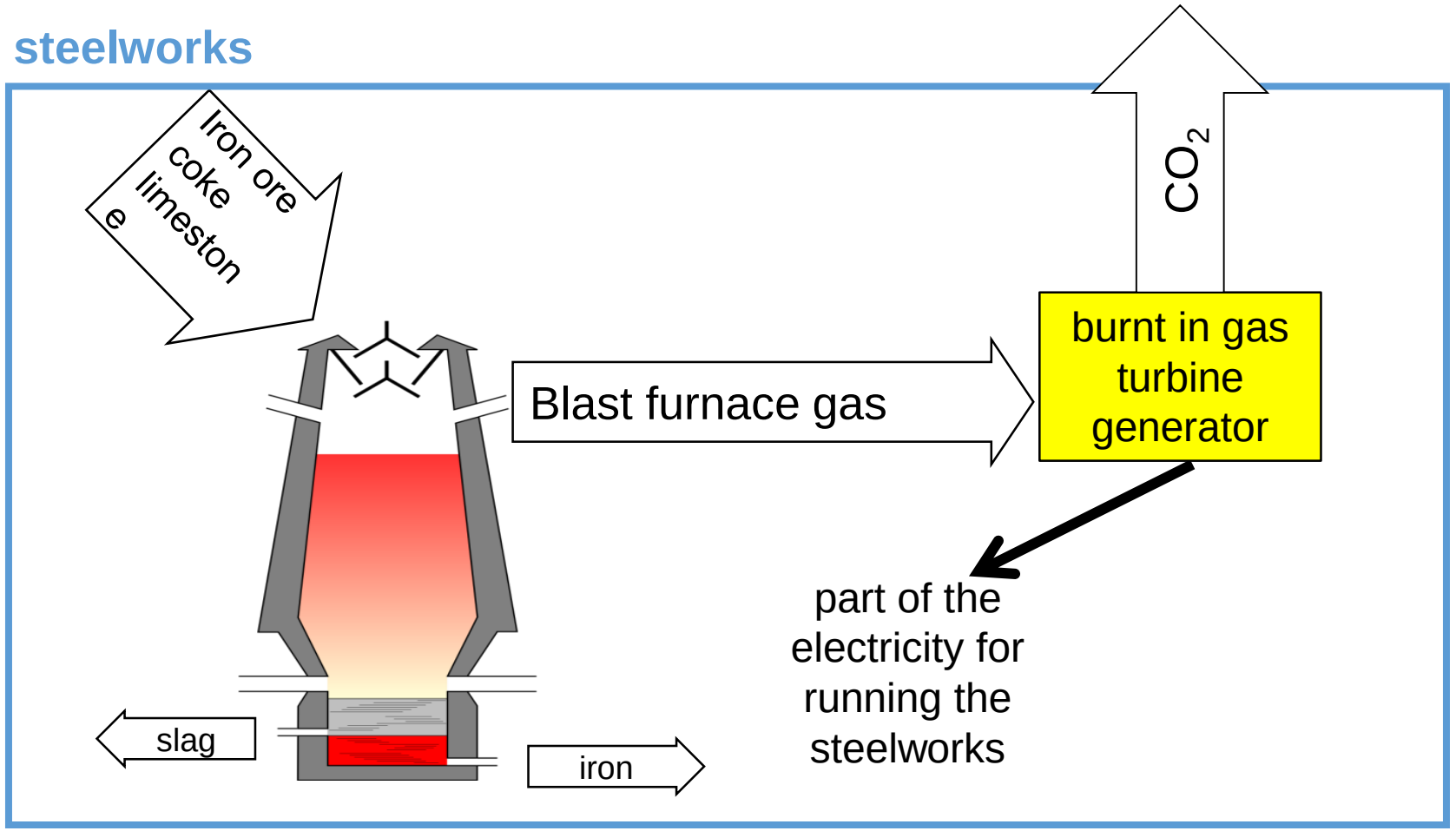
2. GHG INTENSITY OF INPUTS

IT DOESN'T MATTER WHAT YOU CALL YOUR INPUT…

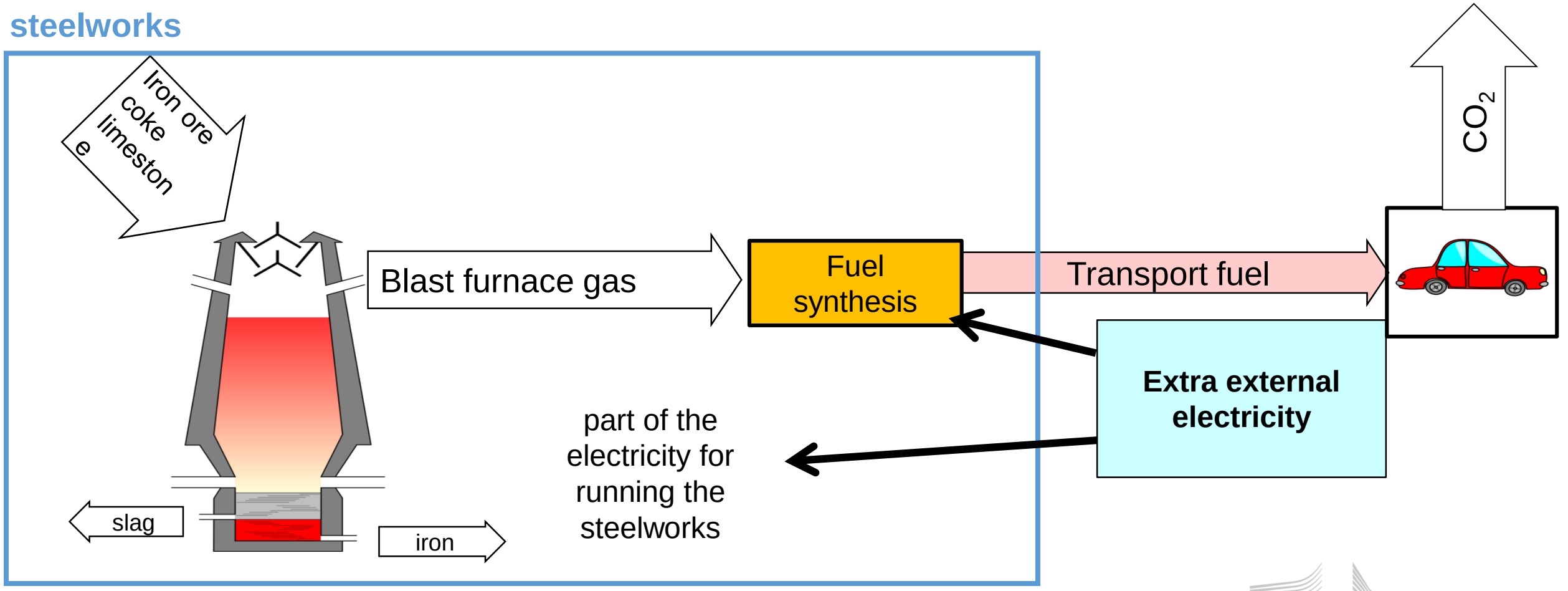
- To calculate GHG intensity of an input in a project calculation…
- it **doesn't matter** what you call it (product, waste, residue, by-product, co-product, intermediate product…)
- The first question is…
  "is the source **elastic or rigid**?"

Let's start with an example….

RIGID input
e.g. Blast furnace gas which is presently burnt to generate electricity for use inside the steelworks



(Diverted blast furnace gas) + electricity = transport gas



Crazy LCA result by energy-allocation: GHGi of blast furnace gas ~230 gCO_2/MJ

1. Find the **total GHG emissions** from the steel mill + transport fuel process.
2. Add the **upstream emissions** for providing the coal, iron ore, scrap, electricity, etc.
3. **Allocate** the total GHG emissions between products. (there is no basis for allocation market value because blast furnace gas does not leave the steelworks) according to their LHV energy content**:
    1. steel (theoretical LHV = 6.6 GJ/tonne, practical LHV = 0)
    2. slag? (sold at ~5 to ~100 Eur/tonne)
    3. Blast furnace gas

- The allocation rule means all products get the same emissions per MJ (LHV).
- …and as steel is by far the biggest product…

emissions for blast furnace gas ≈ emissions for steel ≈ **230 g CO_{2e}/MJ!**

…on the other hand if you say blast furnace gas is a "waste or residue" its emissions are zero in RED: a game of semantics.

** (there is no basis for allocation by market value because blast furnace gas is used entirely inside the steelworks)

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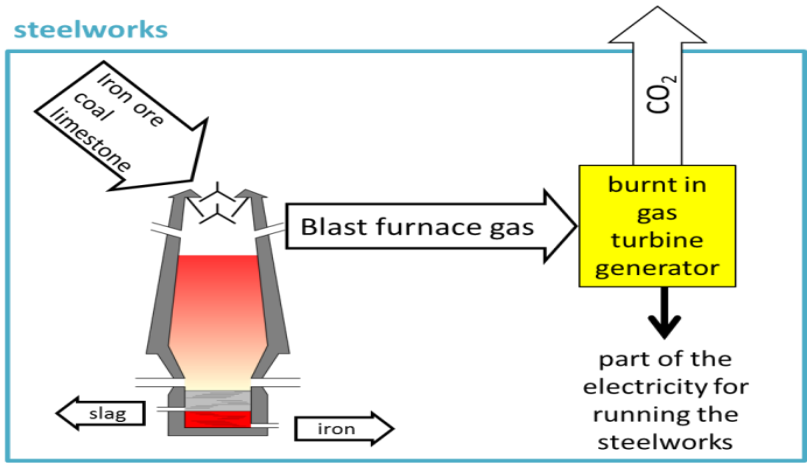
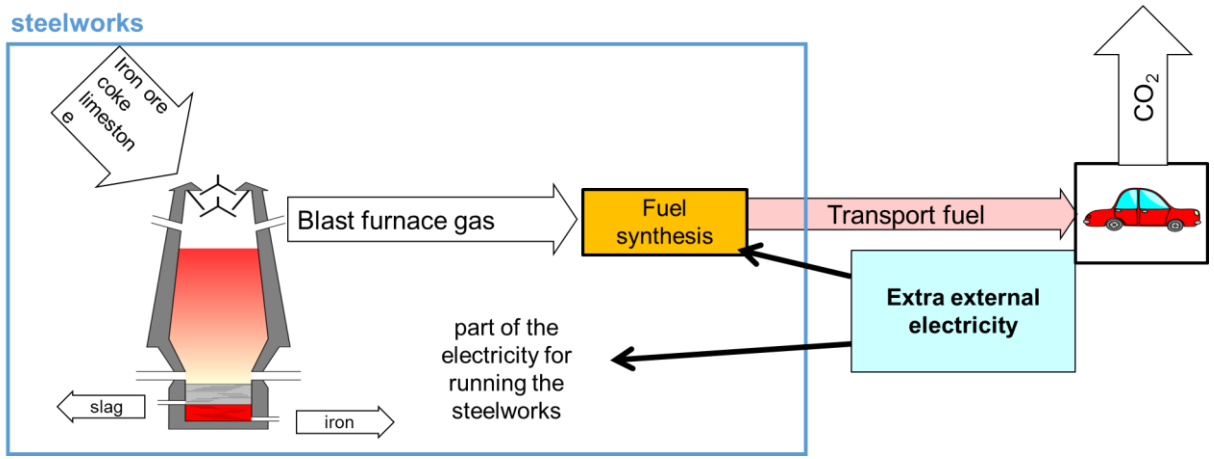
…and if we use common sense?....



BEFORE



AFTER

…we only added external electricity

Carbon intensity of transport-fuel = emissions from providing the extra external electricity

For rigid input, we look at the emissions saved in its existing use. In this case, it means the difference between “before” and “after” use for fuel production.

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Elastic vs. rigid inputs

- **Elastic** if the supply expands with increasing demand:
  - e.g. crude oil, crops, algae
  - ➢ **Estimate the emissions for increasing the supply**

- **Rigid** if the supply doesn't expand if you increase the demand:
  - **e.g.** Municipal waste
  - intermediate products of existing processes, e.g. blast furnace gas
  - by-products that don't change the process profitability much

Rigid inputs not all wastes!

Not zero emissions!

  - **Therefore it can only be diverted from an existing use**
  - ➢ **the GHG intensity is the emissions saved in its existing use**
    - can be negative: e.g. if municipal waste is otherwise burnt without energy recovery
    - can also be very high, if the existing use saves lots of GHG

Elastic or **rigid**: where do we draw the line?

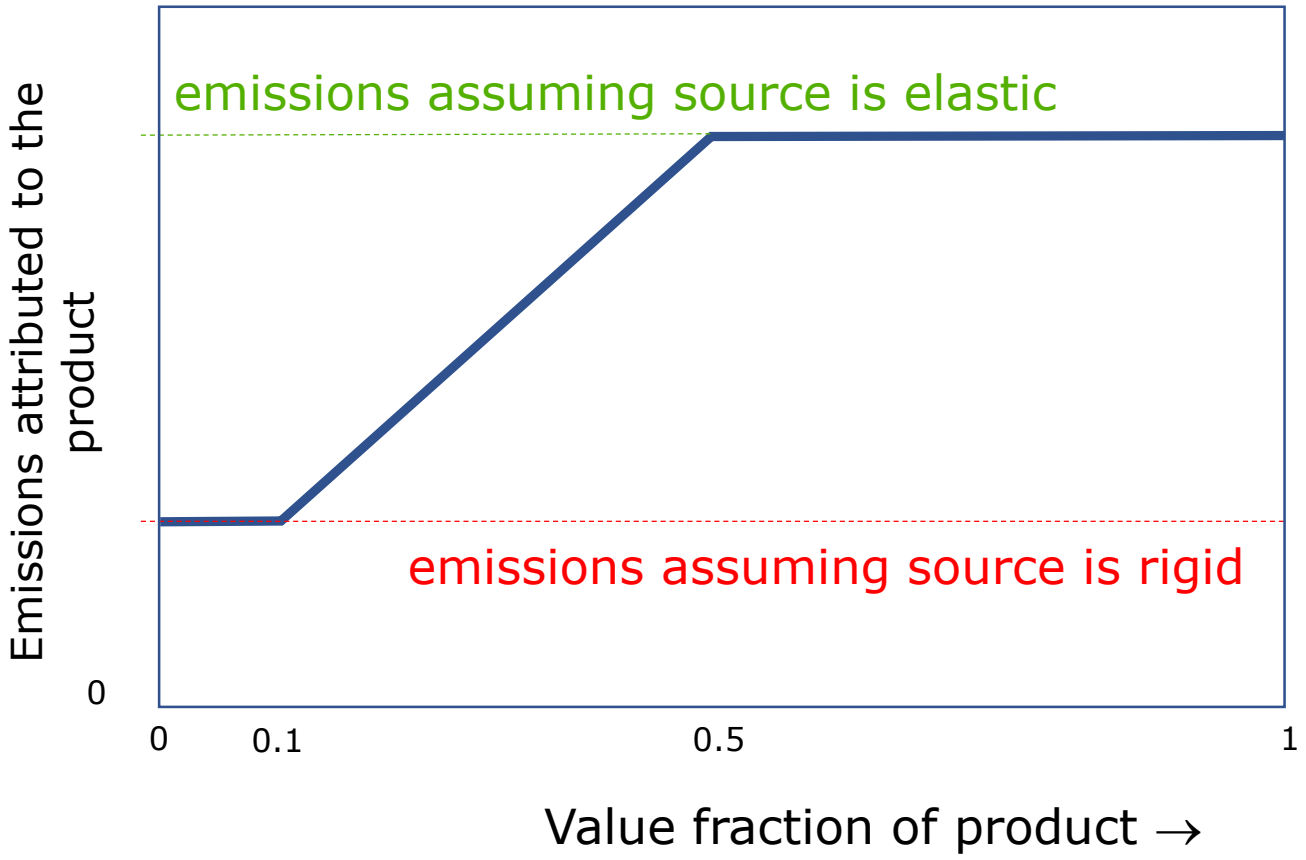
Most inputs are clearly either mostly elastic or rigid, but there are always borderline cases with co-products.

The parameter describing the elasticity of the supply of co-product "A" can be defined as the fraction *of A in the total value of the products of the process*.

A *sudden* transition from "rigid" to elastic" will give problems in borderline cases.

To avoid a sudden transition, but to keep most inputs either elastic or rigid, we envisage a "transition region".

Emissions for inputs in the transition region get a proportional mix of the rigid and elastic results.



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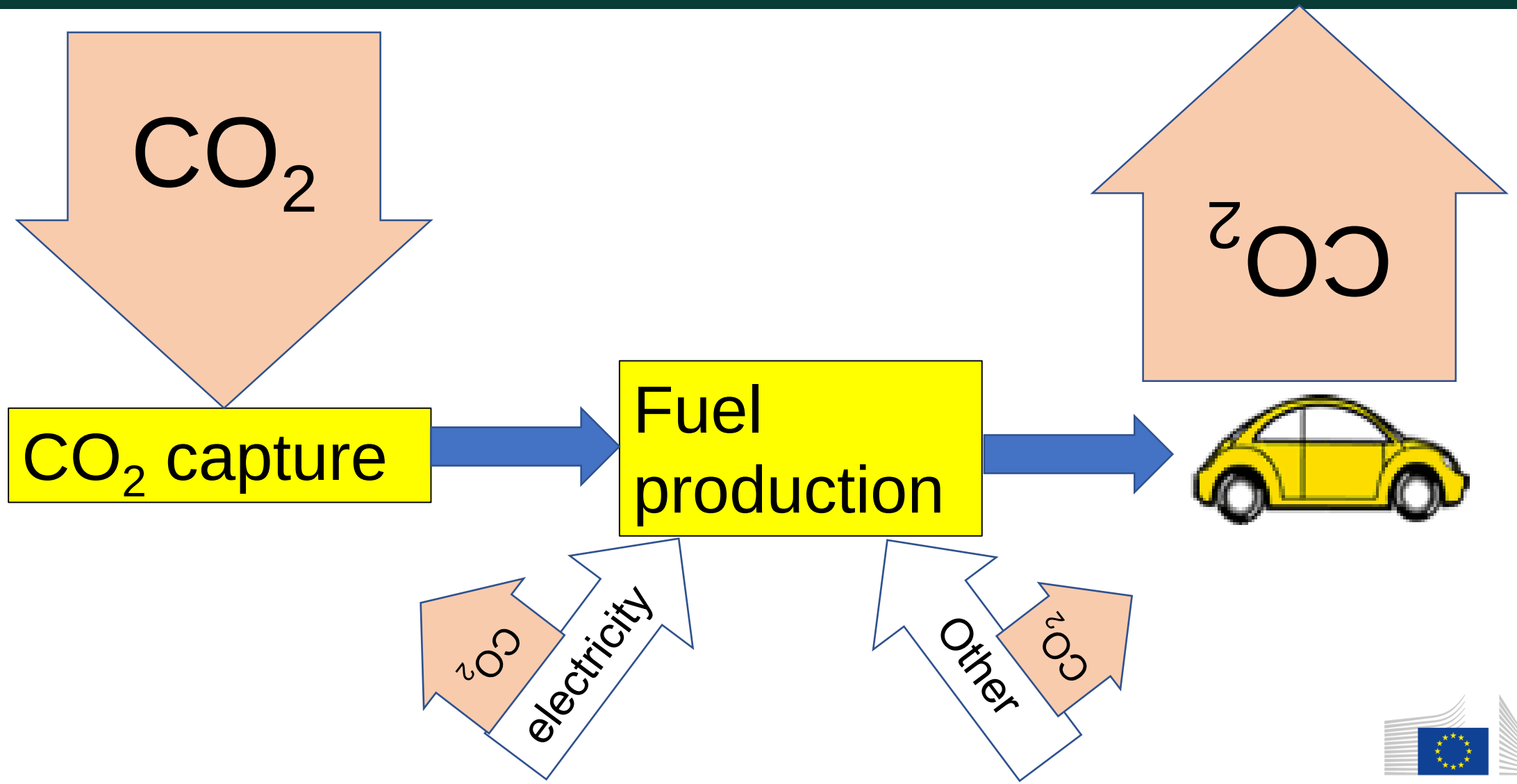
3. Accounting for CO_2 capture

3.1 Straight electrofuel: CO_2 captured = CO_2 from car



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Accounting for CO_2 capture

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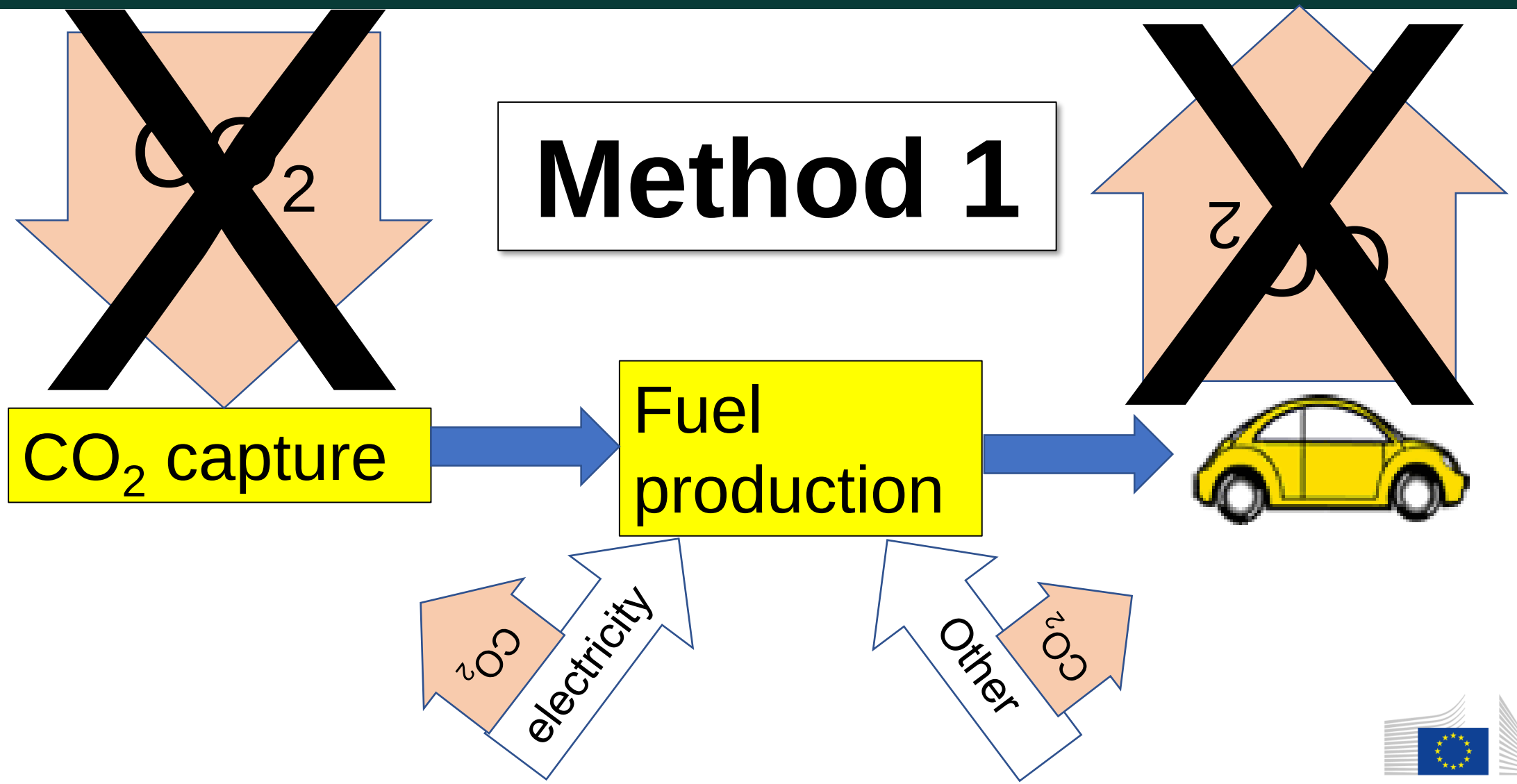

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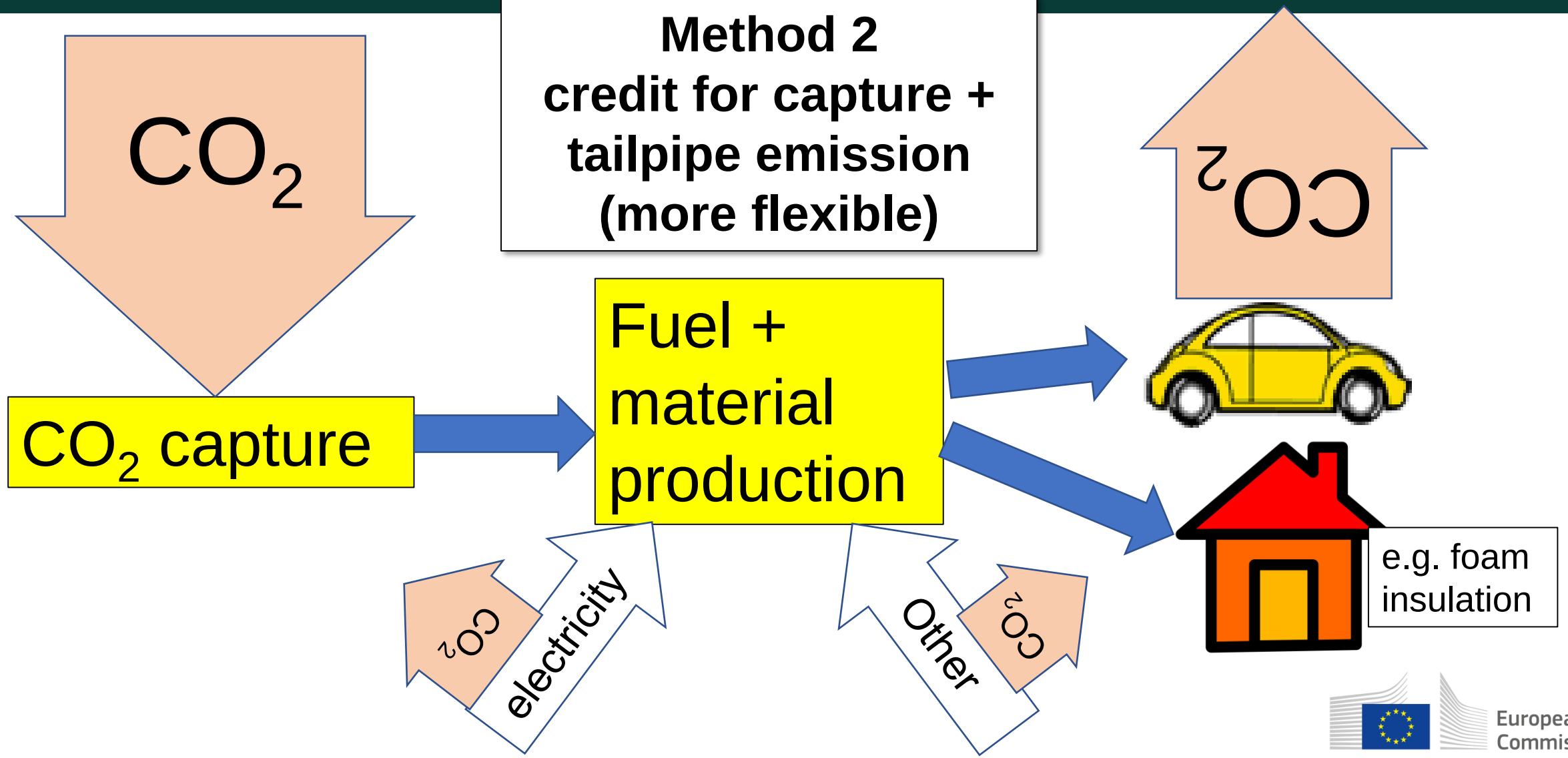
If there is a permanent CCU by-product, you need a CO_2 credit, and also count combustion emissions

Method 2
credit for capture + tailpipe emission (more flexible)



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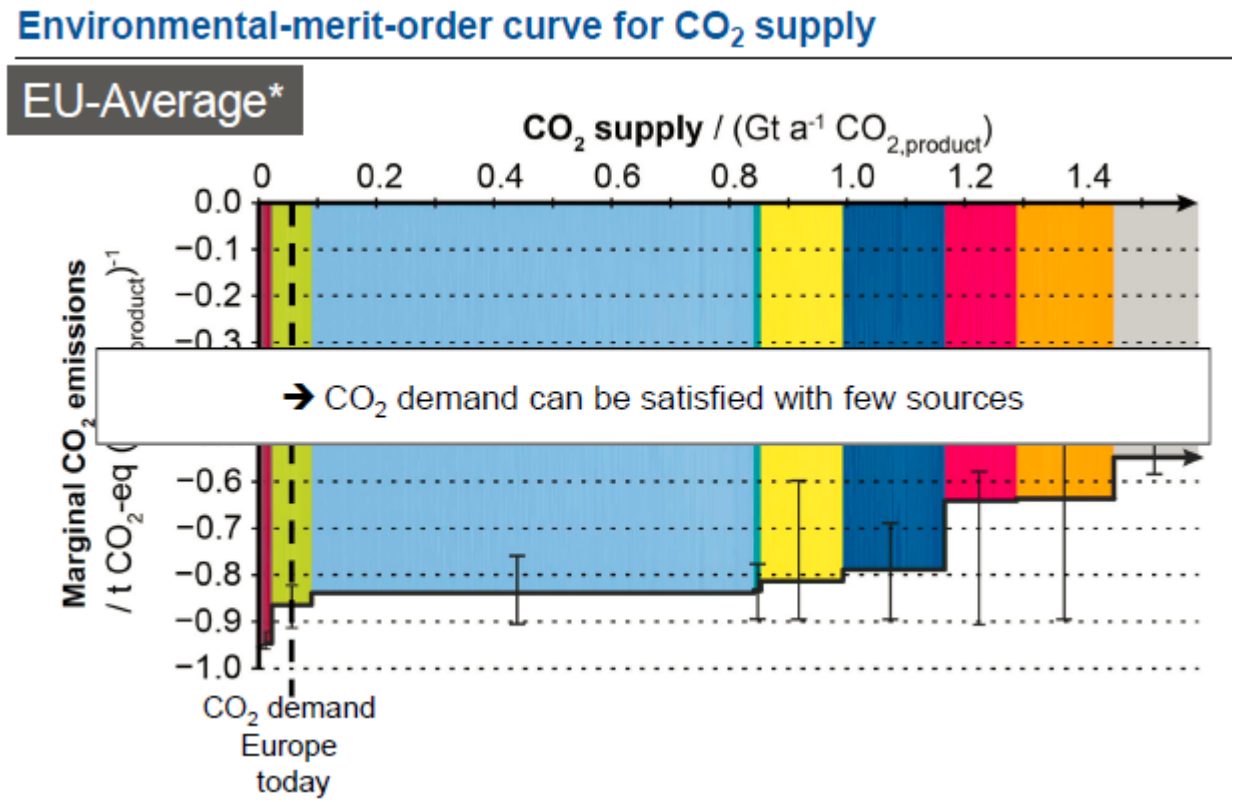
Recycling of CO_2 is limited by the *demand* for CO_2 So CCU credit goes to increased DEMAND for CO_2.

There is much more concentrated-CO_2 available than the market can use.

- So an increase in industrial CO_2 **demand** will result in more capture
- Therefore, incentives should be for the ***use*** of captured CO_2 to replace fossil C.
- (Just incentivizing the *capture* –without an increase in CO_2 demand- only displaces CO_2 already captured elsewhere.)



Reference: N. von der Assen, L.J. Müller, A. Steingrube, P. Voll, A. Bardow, Environ. Sci. Technol., 2016, 50 (3), pp 1093–1101

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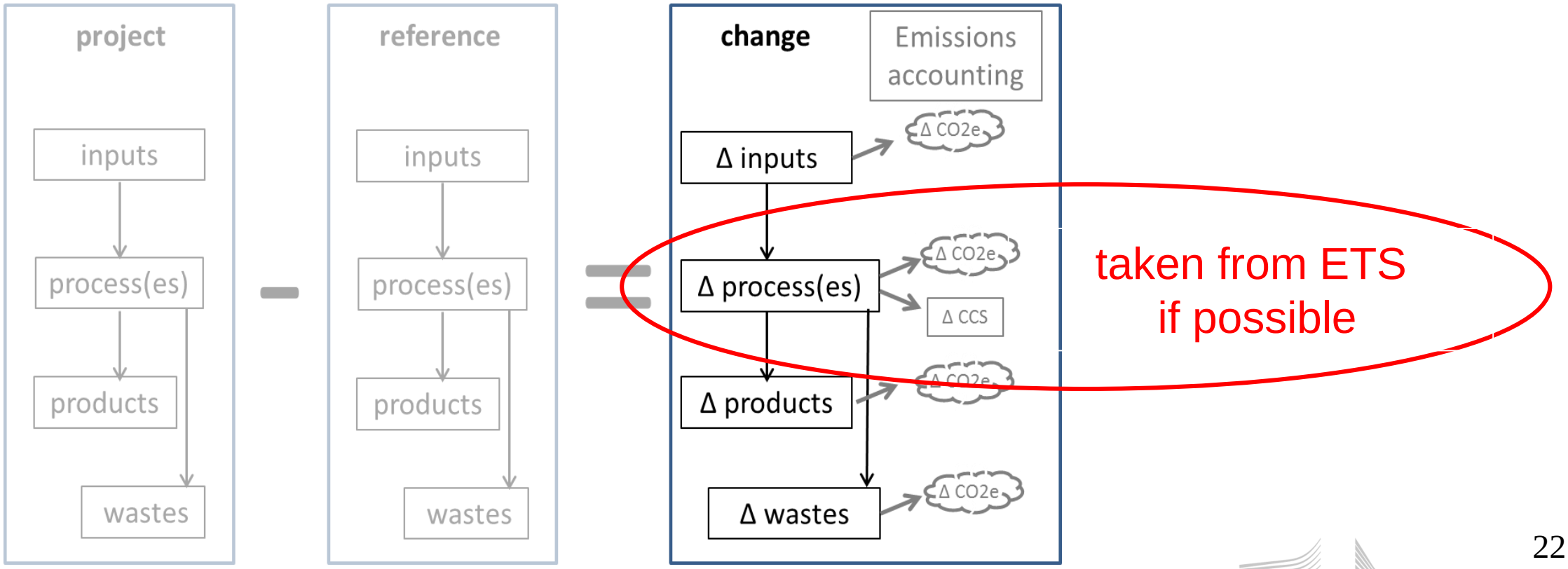
4. Emissions PER UNIT OF PRODUCT : allocation

For calculations of inputs… (not for the whole project)



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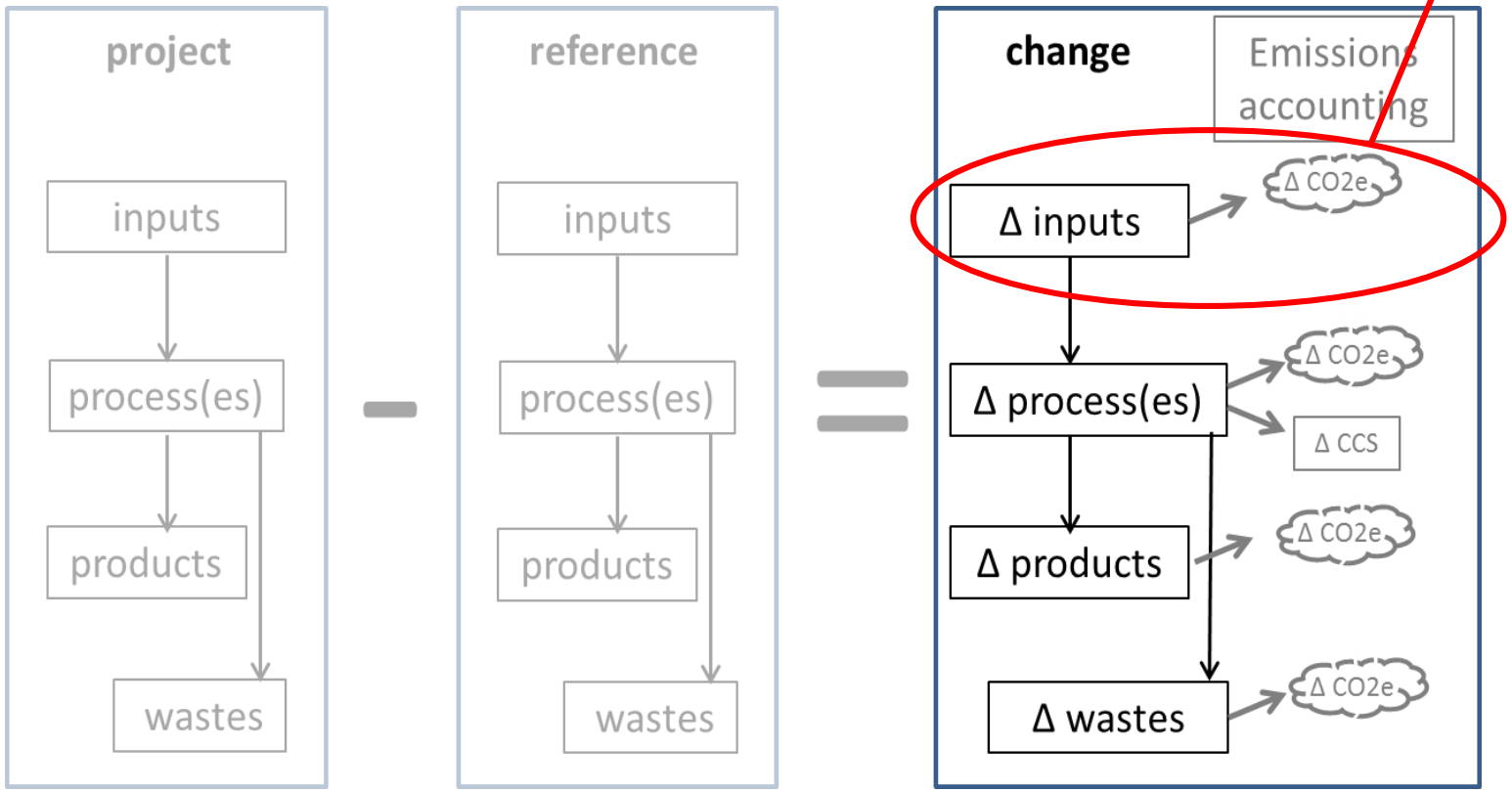
4. Emissions PER UNIT OF PRODUCT : allocation

If an input comes from another process which has multiple products, we have to share the emissions between the different products.

4. Emissions PER UNIT OF PRODUCT : allocation

Allocation is needed for calculations of inputs, when they are one of a number of products of another process …



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emissions PER UNIT OF PRODUCT : allocation

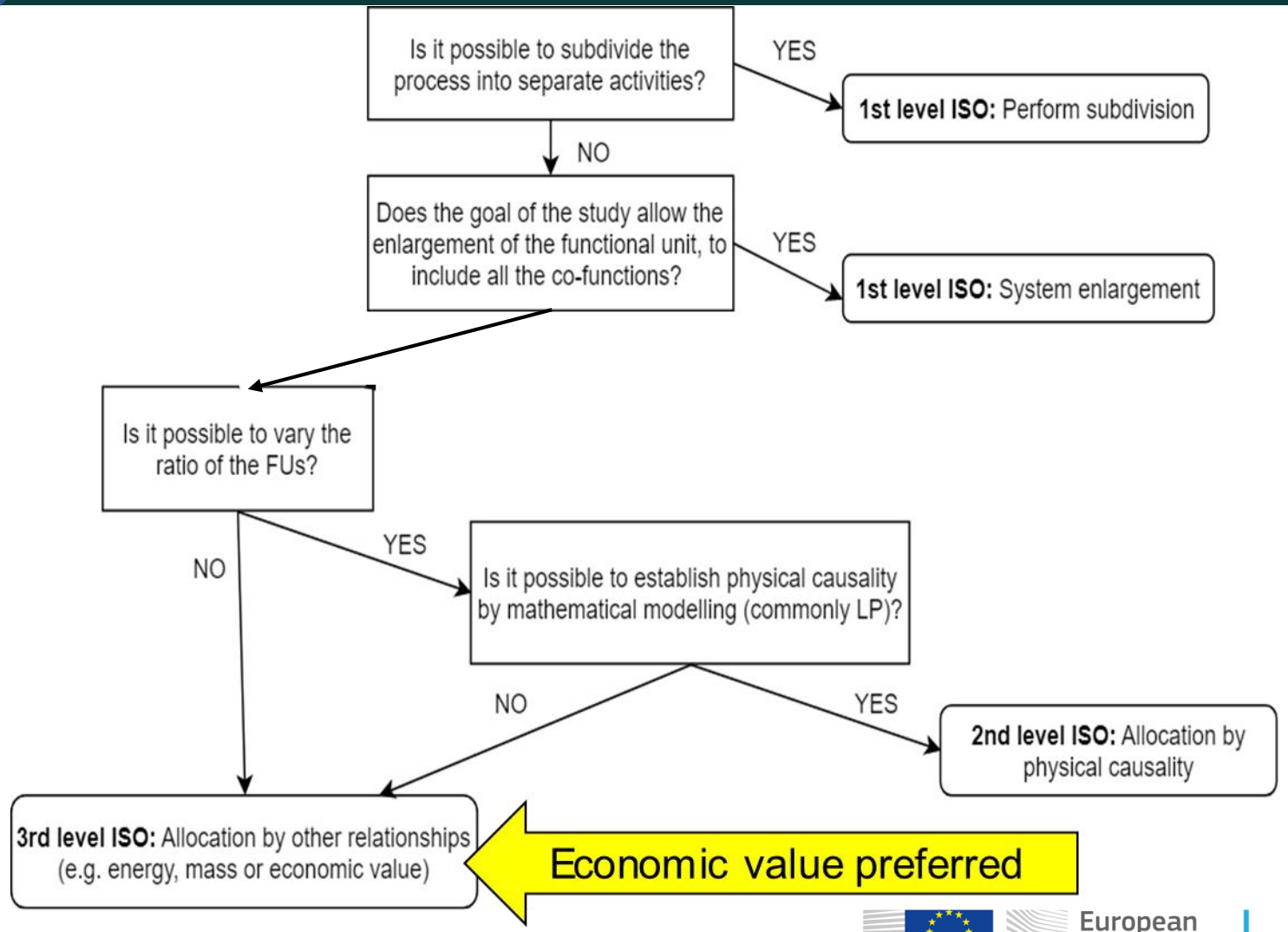
Our proposed allocation scheme
(based on ISO for attributional LCA)

- Allocation applies to elastic products/inputs only

ISO 14041 deals with it correctly but is very often misinterpreted.

Main problem in the literature:

- To use allocation by a physical property (e.g. energy content), you must prove a causal connection between emissions and that property!
- At the moment practitioners often choose one or two arbitrary allocation keys that are easy to measure or give them the result they want. This is malpractice.
- Allocation at 3rd ISO level must be by economic value unless there is a very good excuse.



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5. ELECTRICITY AS AN INPUT

You don’t save emissions by diverting renewable electricity from other users

The same logic: is your renewable electricity rigid or elastic?

- **Rigid** if it is already counted towards renewable electricity targets
  (then it is just being diverted from other users)
  - Its GHG intensity is that of the extra grid electricity that replaces the diverted RE
- **Elastic** if it is **additional** to what would have been consumed anyway:
  e.g. from peak-shaving, or not grid connected,
  ….or potentially an improved guarantees-of-origin scheme
  e.g. similar to GOplus (©Oekoinstituut) + time-dependence
  - Its GHG intensity is that of the renewable source
  - **In RED, wind and solar are simplified to zero emissions. DISCUSS**

Proposed additionality criteria for electricity

(copied from RED2)

Grid-connected electricity is counted as renewable only if …

- it does not count towards national RE targets
- the RE installation is additional and part of the project
- it is only used when the RE installation is producing that electricity
- it's produced close enough to the plant that it does not contribute to grid congestion

What about electricity emissions when it is not "renewable and additional"?

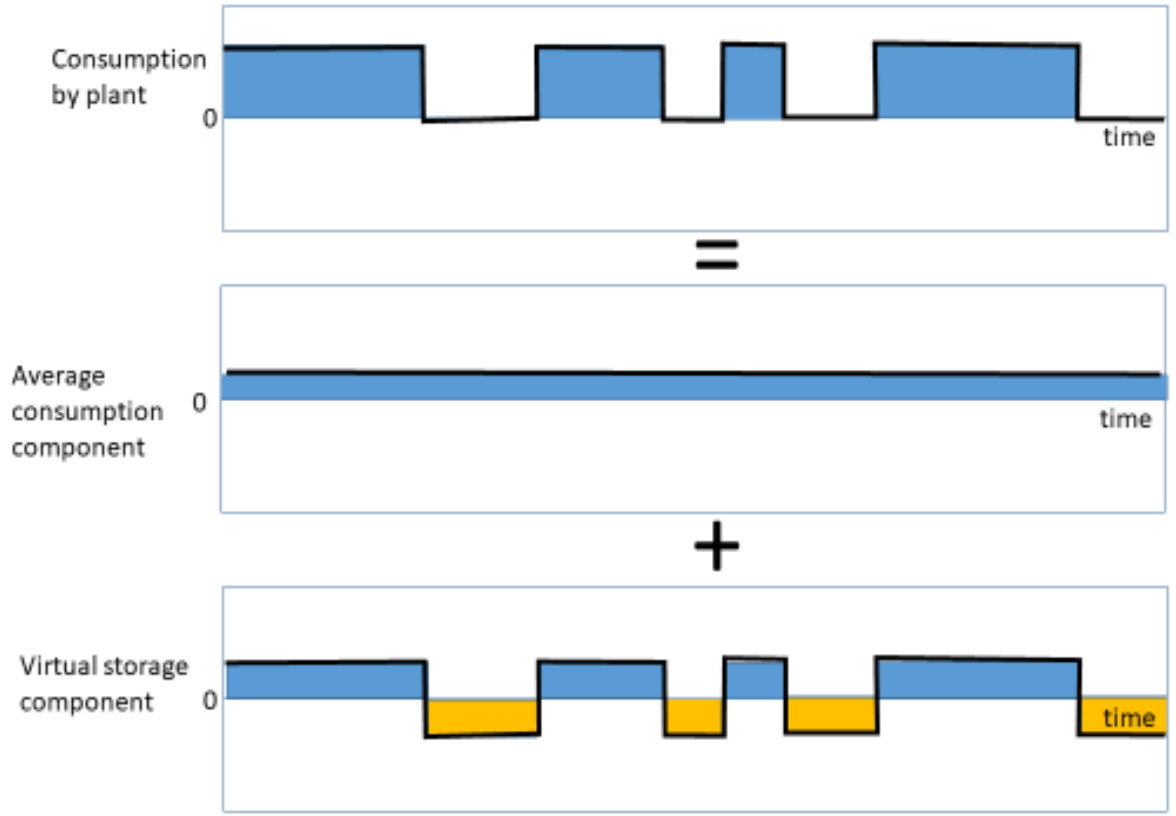
Work in progress

- Rationally, the correct electricity emissions to apply are the **marginal*** emissions for the electricity **consumed*** whilst the plant is in operation.
- We (and CLIMA's consultants) are working on establishing a method to calculate this per electricity trading block, both for **continuous/random plant operation** and as a function of time, to allow emissions savings from **part-time operation**.
- This also enables calculation of the GHG benefit of **electricity storage** projects.
- *In this context, hydroelectricity is not a **marginal** source of electricity, because if you use the water now, you cannot use it later. So it's actually baseload + storage
- *Emissions for **consumed** electricity include
  - upstream emissions for supplying the fuel
  - transmission losses
  - accounting for power station own-use and heat export
  - accounting for trade of electricity

For minor electricity inputs we could suggest the average of EU-mix and national consumption-emissions (avoids wasting hydroelectricity that is needed to stabilize the EU grid).

Electricity storage emissions (from consultants) need to be integrated into this methodology

- e.g. an electrolysis part of an electrofuels plant can be operated only when the GHGi of the electricity is low.
- The resulting GHG benefit can be calculated by resolving the electricity demand into 2 components:



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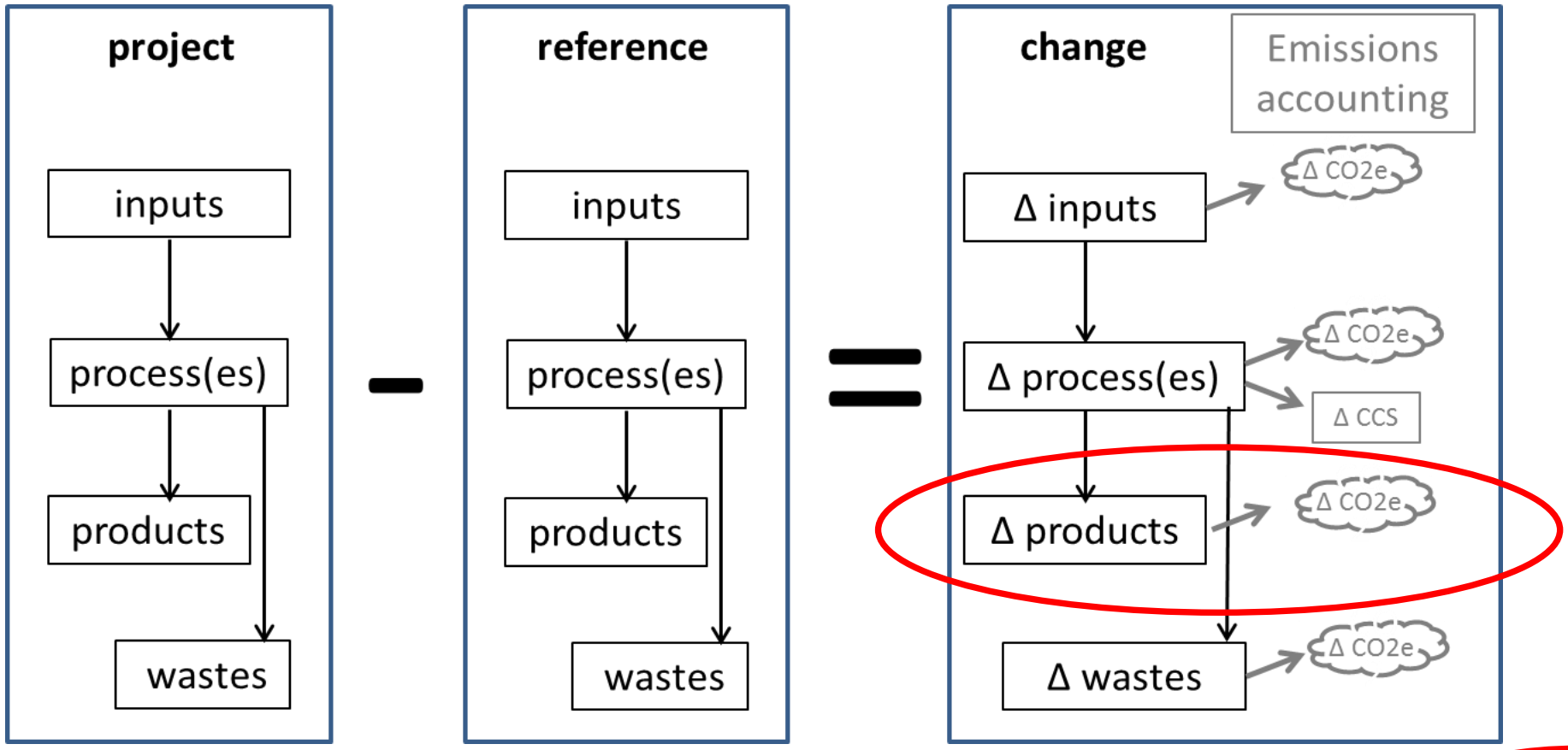
6. Accounting for savings in the usage phase

- Some projects get emissions savings from the **use phase**
  - Some projects have GHG effects in both production and use phases
  - Use-phase emissions savings fit in to our overall structure as part of the ΔE(products)
  - e.g. H_2 cars, alternative refrigerants, production of components for RE and energy storage…

Accounting for savings in the usage phase



ΔEmissions(project) = ΔE(inputs) + ΔE(processes) + ΔE(products)

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The END

Any questions?

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